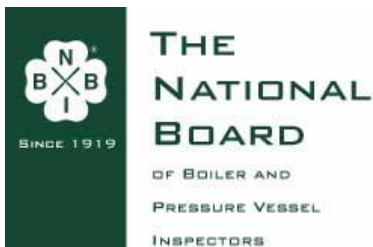




Pressure Relief Device Inspection

Review of NBIC Part 2, par. 2.5

Prepared by: J. F. Ball, P. E.
Updated November 2016



Purpose of Pressure Relief Devices



- Last line of defense against overpressure condition
- Overpressure could lead to failure of the boiler or pressure vessel (PRI)
- Protection for both persons and property
- PRDs are *not* designed as pressure control devices!

Keys to In-service Inspection



- Safety considerations
- Pressure relief device and PRI data
- Device condition
- Installation condition
- Testing and Operational Inspection

Safety Considerations



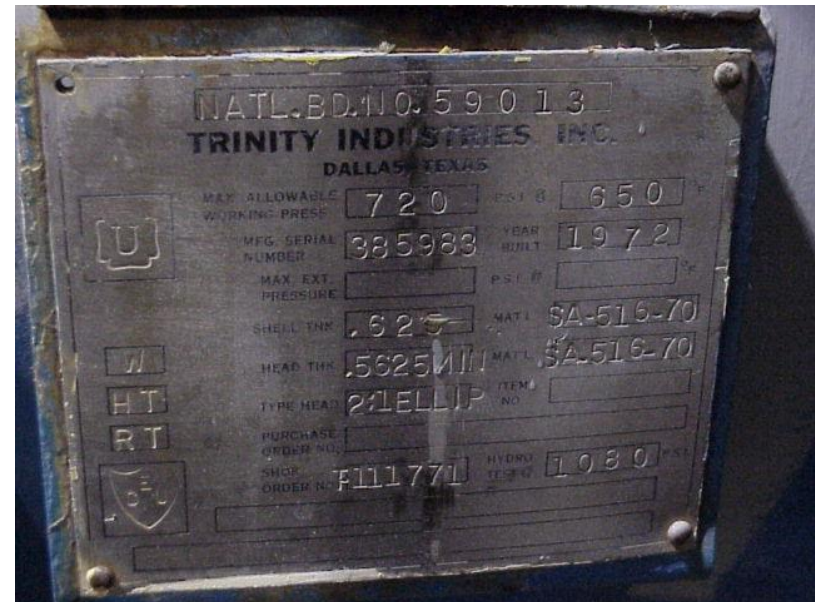
- High pressure discharge may have considerable energy released
- High temperatures may be involved (steam)
- High levels of noise encountered during testing

PRI Data



First look at application and PRI nameplate

- Determine MAWP and design temperature
- Determine steaming capacity or heating surface for boilers
- What is the service fluid?



Device Data



Correct Code Stamp for application



- Power and heating boilers



- Low pressure steam heating boilers, hot water heating boilers, hot water heaters



- Unfired pressure vessel service



ASME Certification Mark with Designator



X

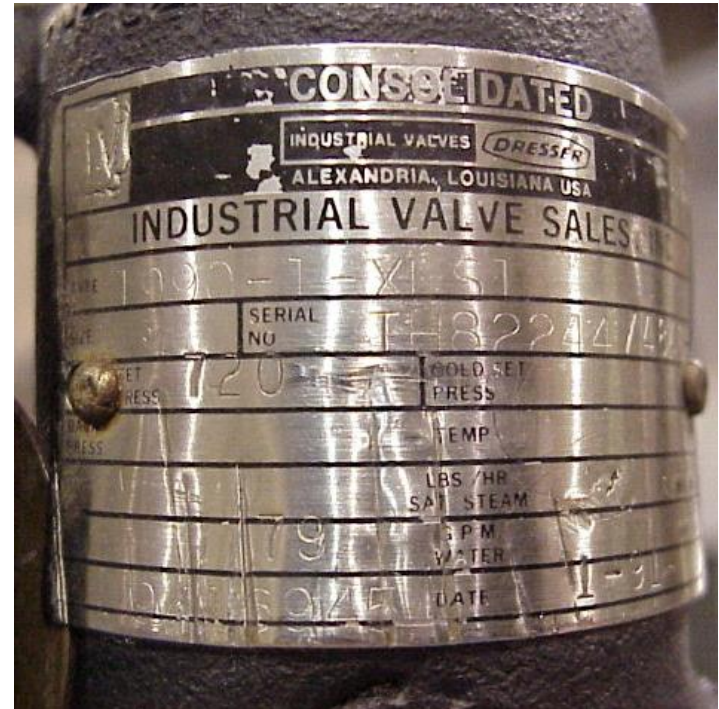
- New ASME Certification Mark
- Replaced previous Code stamps after 2013
- “Designator” gives service
- V, HV, UV, or UD for pressure relief devices

Device Data – Set Pressure



Inspect pressure relief device nameplate data

- Set pressure for single device cannot exceed MAWP
- Set pressure of *high set device* where multiple devices are installed may exceed MAWP
 - +3% for Section I boilers
 - +5% for heating boilers
 - +5% for pressure vessels
 - +10% for pressure vessel fire case
- Section I valves must have spread less than 10%





Device Data

Repair plate could change data on original plate

NB Cert #	REPAIRED BY THE VALVE CO. SMALLVILLE, KS	VR Symbol
<input type="checkbox"/>	SET:	CDTP: <input type="checkbox"/>
MODEL:		
CAP.:		
DATE:	RECORD No.:	

Device Data



Valve may also have “test only” nameplate

- Will show date of test
- Responsible party
- Gives traceability if valve reset

Missing Nameplates



2013 ASME Code, Section I, Appendix III included
“CRITERIA FOR REAPPLICATION OF A CERTIFICATION
MARK”

- Not practically written for pressure relief valves
- NBIC Part 3, par. 5.12.5 includes provisions for duplicate nameplates (must be done along with VR repair)
- Includes “Sec.I” instead of Code stamp

Device Data - Capacity



- For boilers, combined valve capacity must exceed maximum designed steaming capacity
- NBIC Part 1, Table 2.9.1.3 gives calculation method when heating area is used (need to know boiler fuel)

Device Data - capacity



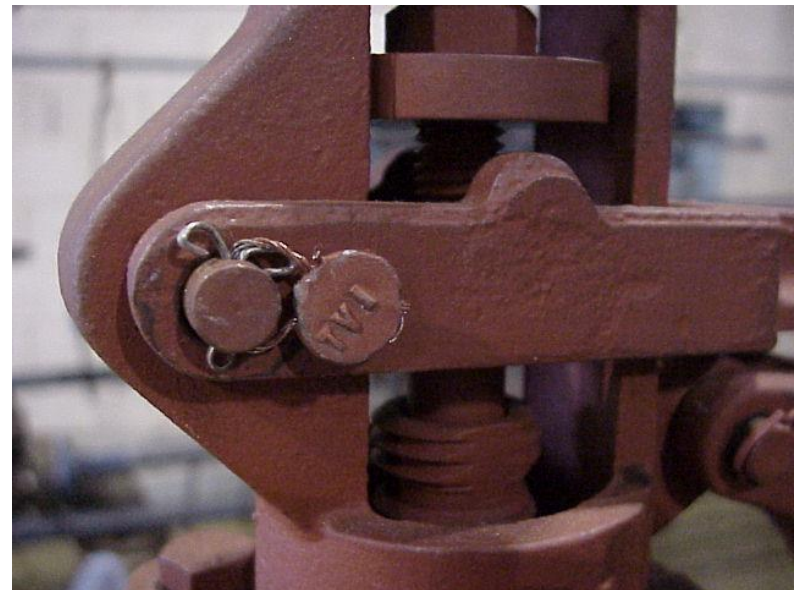
Compare valve capacity in BTU/Hr to burner input for heating boilers

- Has burner or fuel been changed?



Device Data – Valve Seals

- Valve seals must have correct identification
- Valve seal identification must match other information on the valve
 - OEM seal
 - Repair company seal should match repair nameplate
 - Seal may match “test only” nameplate



Device Condition



- Seals intact
- Bolting tight and no bolts missing
- Deposits or material buildup
- Damaged or missing parts



Device Condition

Small valves may be
permanently sealed
(what's wrong here?)



Device Condition

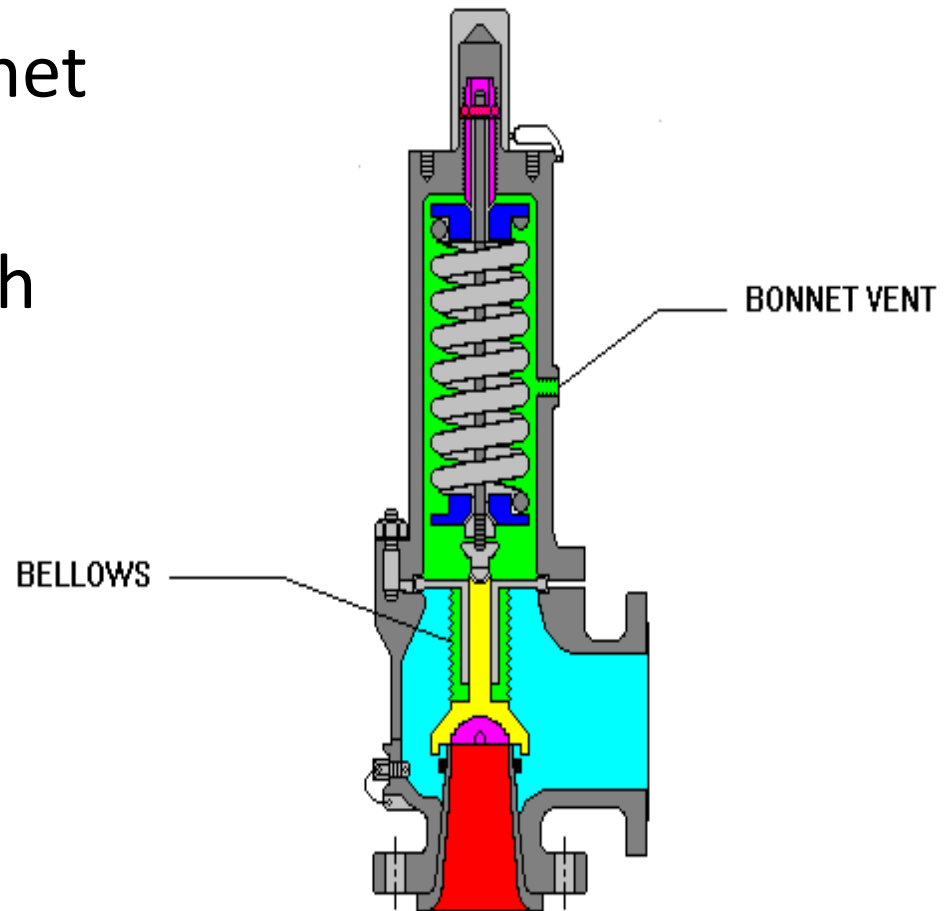
- Valve should not be leaking
- Drain hole not clogged or plugged



Device Condition



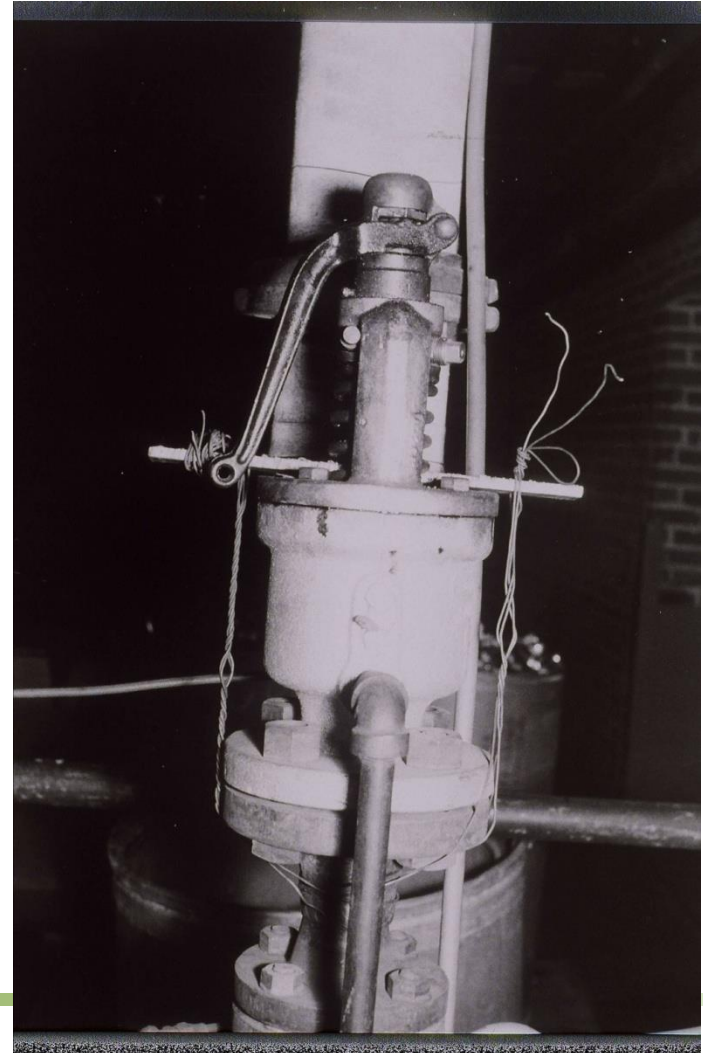
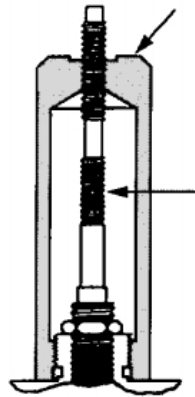
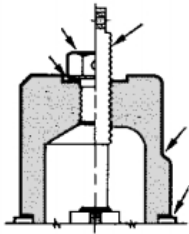
- Bellows valve bonnet vent not plugged
- No leakage through bonnet vent



Device Condition



No test gag!

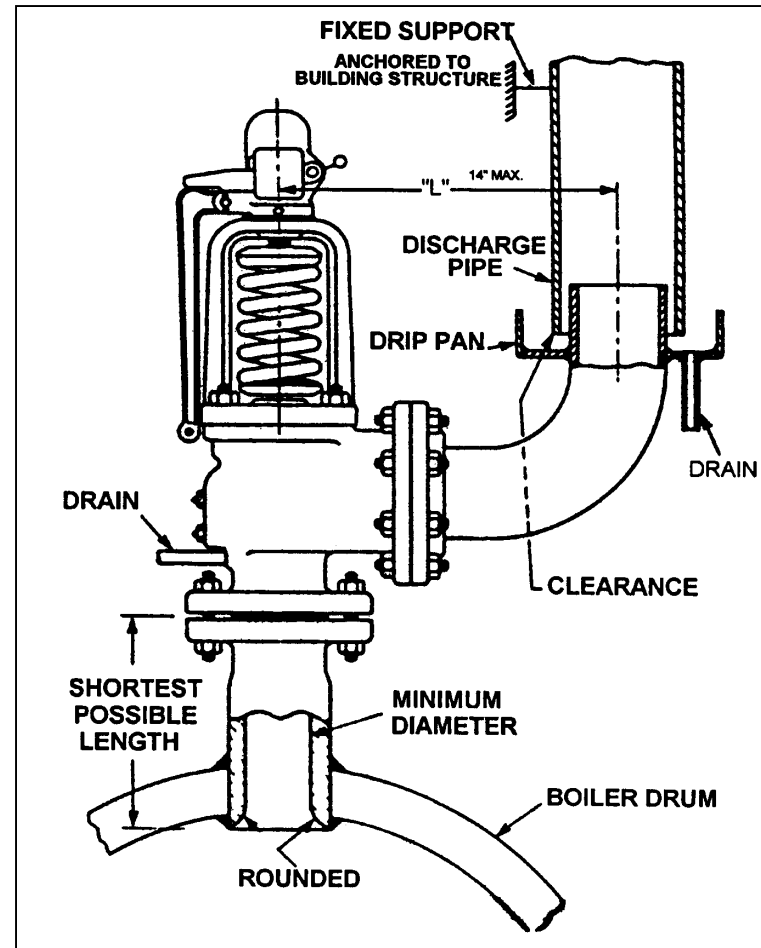


Installation Condition

- No reduced inlet or outlet pipe sizes
- Drain piping open
- Piping should not be binding on valve
- Piping should not be supported by valve
- Discharge hazards to personnel



Typical ASME Section I Safety Valve Installation



Installation Condition



What's wrong here?

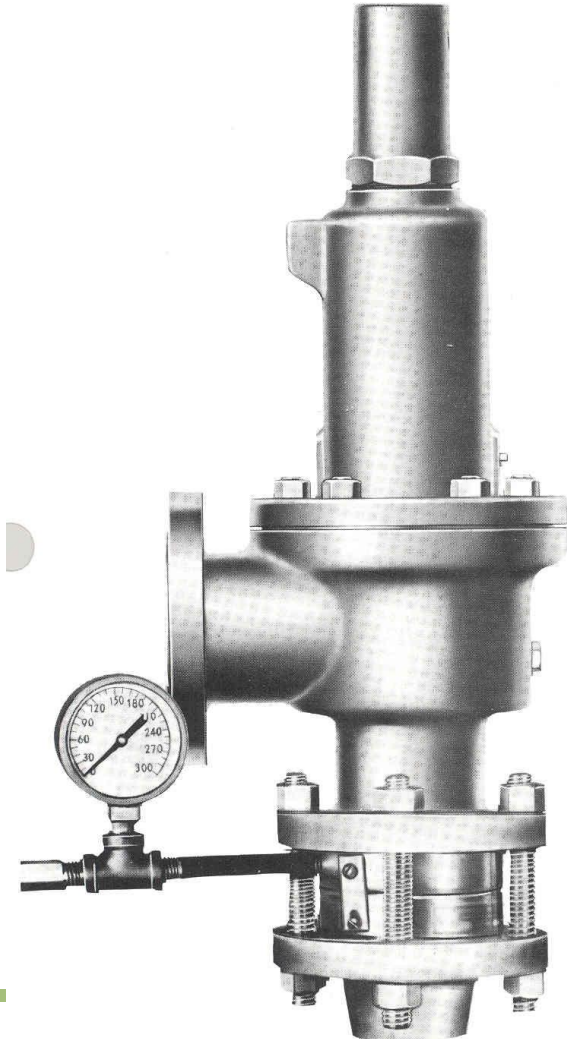


Installation Condition



Installation Condition

- Rupture disk installation under PRV
- No pressure on gage





Installation Condition



Isolation valves

- Not permitted for boilers or hot water heaters
- May be permitted in some pressure vessel applications
 - ASME Code Appendix M requirements
 - *Jurisdiction must approve*

Installation Condition



Change-over valves



Testing and Operational Inspection



- Does the valve actually work?
- Lift lever test
 - At least it's not stuck shut...
 - Test at 75% of set pressure for boiler or pressure vessel valves
 - Section IV valves can be checked without pressure
 - Section VIII: Test lever required for valves for steam, air, and hot water over 140 deg. F.

Testing and Operational Inspection



- Rope can be tied to lever for personnel safety
- Assure rope does not affect valve
- Allow valve to “snap” shut



P1000425.mov



P1000428.mov

Testing and Operational Inspection



- Set pressure test
 - Set pressure within Code tolerance
 - Valve should not be leaking
- Full pressure test on unit (not accumulation test)
- Remove valve and check on test stand

Testing and Operational Inspection



Lift assist devices
sometimes used to
check valve on-line
without a full pop test



Testing and Operational Inspection



- Corrective Action
 - Remove system from service if valve is stuck shut! (+16%)
- Out of set pressure tolerance (NBIC Part 2, par. 2.5.7 g))
 - “Minor” adjustment = 2x set tolerance
 - Must be done by qualified organization
 - “Major” adjustment indicates a repair is needed

What is a Qualified Organization?



- NBIC defines a “qualified organization” as an “organization accredited by the National Board”
- Could be National Board VR or T/O certified organization
- Part 3, Supplement S7.10 gives outline of requirements for potential Jurisdictional acceptance

Recommended Test Frequencies



- Jurisdictional Rules
- NBIC recommendations
 - Boilers less than 400 psi – manual test every 6 months, annual pressure test
 - Boilers greater than 400 psi – Pressure test every three years
 - High temp. hot water boilers – annual pressure test
 - Low pressure boilers (15 psi) – manual test quarterly, annual pressure test before heating season

Recommended Test Frequencies



- Hot water heating boilers – manual test quarterly, annual pressure test before heating season
- Hot water heating boilers – manual test quarterly, annual pressure test before heating season
- Water heaters – manual test every 2 months (replace if defective)

Recommended Test Frequencies



Pressure Vessel and Piping Applications

- To determine inspection frequency, the vessel contents, system operation, and previous inspection history must be reviewed
- Steam – annually
- Air, clean dry gasses – every 3 years
- PRV with rupture disk – 5 years
- Propane, refrigerant – 5 years
- All others – Per Inspection History

Sample Inspection Checklist



Sample Inspection Checklist for Pressure Relief Devices (Based on NBIC Part 2, Section 2.5)

1. Valve Type _____
2. Set pressure _____
3. Object being protected _____ Code Section _____
4. Object MAWP _____
5. Set pressure LT or equal to MAWP: Yes _____ No _____
6. Set pressure seal intact Yes _____ No _____
7. Adjusting ring(s) seal intact Yes _____ No _____ N/A _____
8. Seals match mfg. / repair / test nameplate? Yes _____ No _____
9. Inspection done with valve: Installed _____ Removed _____
10. Evidence valve is leaking Yes _____ No _____
11. Connections (bolting) tight Yes _____ No _____
12. Evidence of rust or corrosion Yes _____ No _____
13. Body drain open Yes _____ No _____
14. Test gag Yes _____ No _____
15. Bonnet vented for bellows Yes _____ No _____ N/A _____
16. Inlet pipe GT or equal to valve inlet size Yes _____ No _____
17. Outlet pipe GT or equal to valve outlet size Yes _____ No _____ N/A _____
18. Drain pipe open Yes _____ No _____
19. Binding of inlet or outlet piping Yes _____ No _____
20. Discharge pipe support OK Yes _____ No _____
21. Discharge to safe location Yes _____ No _____
22. Isolation valve(s) used? Yes _____ No _____
23. Inlet pipe and valve inlet deposits? Yes _____ No _____ N/A _____
24. Outlet pipe and valve outlet deposits? Yes _____ No _____ N/A _____
25. Test method: Pop test _____ lift lever check _____
26. Measured set pressure: _____ Acceptable: _____, Not acceptable _____
27. Seat leakage: _____ Acceptable: _____, Not acceptable _____

Comments: _____

Inspected by: _____ Date _____

Corrective actions required/ taken:

Corrective actions completed by: _____ Date _____

Final Exam (outlet piping)



Final Exam



Final Exam



What's wrong with this installation?



Conclusions



- Pressure relief devices are important to safe system operation
- Inspections must be done to assure devices are installed and *functioning properly*

THANK YOU!